U.S. Department of Transportation
National Highway Traffic Safety Administration

FORWARD CRASH WARNING SYSTEM CONFIRMATION TEST

November 2007

Office of Vehicle Safety
Office of Crash Avoidance Standards
Room W43-478, NVS-120
1200 New Jersey Avenue , SE
WASHINGTON, DC 20590

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Forward Crash Warning System
Confirmation Test

1. PURPOSE AND APPLICATION

This laboratory test procedure provides the specifications for conducting tests for the confirmation of the existence of a Forward Crash Warning (FCW) System on passenger vehicles under 10,000 pounds gross vehicle weight rating (GVWR). Although it is impossible to predict what technologies could be used in future FCW systems, it is believed that with minor modifications to the test setup, other technologies may be evaluated. Current technology is dependent on radar-based or vision based sensors capable of detecting traffic.

The contract laboratories are directed by this test procedure to use a special test parameter which is dynamic test to assess systems to alert drivers of a potential hazards in the path of the subject vehicle. The requirements of this indicant test procedure must be strictly adhered to; however, the test contractors are encouraged to suggest improved testing techniques to assist in procuring the required test data. Any changes to or deviations from this test procedure must be approved by the Contracting Officer's Technical Representative (COTR).

The contractor's in-house test procedure must have NHTSA approval prior to conducting the first test of a particular fiscal year program. The contractor's test procedure cannot deviate in any way from the NHTSA procedure without the prior approval of the NHTSA COTR.

2. GENERAL REQUIREMENTS

This test evaluates the ability of a forward crash warning system to detected and alert drivers of potential hazards in the path of the vehicle. Three tests are utilized to assess this technology. First, a test is run with a stopped lead vehicle. The test scenario is conducted at a moderate, 45 mile-per-hour speed. Test two is of the subject vehicle following another vehicle at a constant speed, then the other vehicle stops suddenly. This second test evaluates the ability to recognize a decelerating lead vehicle and issue an alert to the driver in a timely manner. The third test tests the ability of the FCW system to recognize the dynamic state of a slower lead vehicle moving at a constant speed and issue a timely alert. This third test scenario is conducted at a closing speed of 25 miles per hour.

3. SECURITY

The contractor shall provide appropriate security measures to protect test vehicles and equipment during the entire test program, and shall be responsible for all equipment removed from test vehicles before and after the test. Vehicle equipment thefts or act of vandalism must be reported to NHTSA authorities immediately. Under no circumstances shall any vehicle components be removed during a visitor inspection unless authorized by OCAS engineers. All data developed from the test program shall be protected.

Rules for Contractors

1. No vehicle manufacturer's representative(s) or anyone other than the contractor's personnel working on the Contracts and NHTSA personnel, shall be allowed to inspect NHTSA vehicles or witness vehicle preparations and/or testing without prior permission of the Office of Crash Avoidance Standards (OCAS). Such permission can never be assumed.

2. All communications with vehicle manufacturers shall be referred to the OCAS, and at no time shall the contractor release test data without the permission of the OCAS.

3. Unless otherwise specified, the vehicle manufacturer's representatives shall only be authorized to visit the contractor's test facility on the day that the test is scheduled, and the representatives must be escorted by NHTSA and/or contractor personnel.

4. Test vehicle inspection by the vehicle manufacturer's representative(s) shall be limited to 30 minutes prior to the start of vehicle test. Post-test inspection shall be limited to 1 hour after contractor personnel have completed their test tasks.

5. Photographs and videos of the test vehicle, associated test equipment and test event shall be allowed. However, test personnel shall not be included in any photographic coverage, and videotaping of vehicle preparation must be approved by OCAS. The contractor's personnel shall not respond to any questions from the manufacturer's representatives regarding this test program. All questions shall be referred to the COTR, an OCAS representative present at the test site, or to OCAS.

6. VISITATIONS - The contractor shall permit public access to and inspection of the test vehicles and related data during the times specified by the NHTSA COTR. NHTSA shall advise interested parties that such access and inspection shall be limited to a specified day, and specified hours and require prior approval from the Office of Crash Avoidance Standards. The contractor shall refer all visit requests from vehicle manufacturer's representatives and consumers to the Office of Crash Avoidance Standards. This service shall be included as an incidental part of the test program and will not result in any additional cost to the NHTSA. The contractor shall make his own arrangements with interested parties for expenses incurred beyond providing access and inspection services. All inquiries by manufacturers concerning the test program (vehicle, procedures, data, etc.) shall be directed to OCAS representatives.

4. GOOD HOUSEKEEPING

The contractor will maintain the entire test area, vehicle pre-test preparation facility, instrumentation building, and equipment configuration and performance verification test laboratory in a clean, organized and painted condition. All test instrumentation must be setup in an orderly manner consistent with good engineering practices.

5 TEST SCHEDULING AND MONITORING

The contractor shall commence testing within four (4) weeks after receipt of the first test vehicle. Subsequent tests will be conducted, if requested, at a minimum of one (1) vehicle test per week. The NHTSA COTR will make adjustments to the test schedule in cases of unusual circumstances such as inclement weather or difficulty experienced by in the procurement of a particular vehicle make and model. All testing shall be coordinated to allow monitoring by the COTR.

6 TEST DATA DISPOSITION

The contractor shall make all test data available within two hours after the test event if so requested by Agency personnel. Under no circumstances shall this data be furnished to non-Agency personnel. The contractor shall analyze the preliminary test results as directed by the COTR.

6.1 Computer Data Tape and Final Hard-Copy

The contractor shall deliver to OCAS the final data, digital printouts, and plots within one (1) week after the test.

6.2 Test Report

6.2.1 This test report shall include all of the items shown in the Sample Test Report. The contractor shall submit **two (2)** CD's and **one (1)** paper copy of the test report to the following address:

U. S. Department of Transportation
National Highway Traffic Safety Administration
Office of Crash Avoidance Standards (NVS-120)
1200 New Jersey Avenue, SE, Room W43-478
Washington, DC 20590

6.2.2 Report Submission

All final test reports shall be submitted to the above listed NHTSA office within **four (4) weeks** from the date of the vehicle test.

6.2.3 Text/Data Sheet Disk

The contractor shall submit **one (1)** CD of the text and data sheet portion only of the test report in Microsoft Word format within **four (4)** weeks from the date of the vehicle test. The full test report including photographs and data traces on a disk may be a future requirement.

6.3 Test Video

OCAS shall receive one **(1)** copy of the color video for each test, and the copies shall be mailed directly to the OCAS within **four (4)** weeks of the vehicle test. The master print for each of the test videos shall be retained by the contractor, but will be made available to the OCAS upon request.

6.4 Data Loss

6.4.1 Conditions for RETEST

The test vehicle is instrumented in order to obtain data needed for the test program. An invalid test is one which does not conform precisely to all requirements/specifications of the laboratory test procedure and Statement of Work applicable to the test.

The contracting officer of NHTSA is the only NHTSA official authorized to notify the contractor that a retest is required.

No test report is required for any test which is determined to be invalid unless NHTSA specifically decides to require the Contractor to submit such report. Invalidated test reports will not be publicly released.

RETEST CONDITIONS

Failure of the contractor to obtain the specified data and to maintain acceptable limits of test parameters in the manner outlined in this test procedure shall require a retest at the expense of the contractor. The provisions of this paragraph apply to, but are not limited to, the contractor maintaining proper speed tolerance, vehicle performance, and test data acquisition, reduction, and processing.

The contractor shall also be responsible for obtaining usable data from all primary channels from instrumentation placed in each vehicle. Failure to produce such data shall also be at the expense of the contractor and shall include vehicle repair or replacement and retest unless the Office of Crash Avoidance Standards determines that the data loss occurred through conditions beyond reasonable and foreseeable control of the contractor. Should it become necessary for the contractor to procure another test vehicle, it must have identical equipment and options as the original vehicle. The retested vehicle shall be retained without fee by the testing facility until its disposal is authorized by the COTR.

6.4.2 Conditions for PARTIAL PAYMENT

The contractor shall exercise reasonable and foreseeable control to insure that no data is lost or rendered useless. If some non-critical data (such as camera failure) and critical data (acceleration data) are not obtained for the test and the test is accepted by the Agency, the Agency will not pay for the missing or lost data.

6.5 Data Retention by Contractor

The contractor shall retain at no extra cost to the agency, reproducible copies of all data (analog and digital), videos, and still photograph negatives or electronic files .

6.6 Data Availability to the Public

The contractor shall provide interested parties with copies of test report, test CD's, test data tapes, test films, and test still photographs, at a reasonable cost to the purchaser, but only after the Office of Crash Avoidance Standards representative has advised the contractor that the results of that particular test have been released to the public by the Agency.

6.7 Indicant Failure Notification

Any indication of a "test failure" shall be communicated by telephone to COTR within 24 hours of the test.

NOTE: In the event of a failure, a post-test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional cost.

7. VEHICLES AND EQUIPMENT (GFP)

ACCEPTANCE OF TEST VEHICLES

The Contractor has the responsibility of accepting leased or NHTSA-provided test vehicles from either new car dealers, leasing companies, or vehicle transporters. In all instances, the Contractor acts in the NHTSA's behalf when signing an acceptance of test vehicles. The Contractor must check to verify the following:

A. All options listed on the "window sticker" are present on the test vehicle.

B. Tires and wheel rims are the same as listed.

C. There are no dents or other interior or exterior flaws.

D. The vehicle has been properly prepared and is in running condition.

E. Verify that spare tire, jack, lug wrench, and tool kit (if applicable) is located in the vehicle cargo area.

The Contractor shall check for damage that may have occurred during transit or prior use. The COTR is to be notified of any damage prior to preparation of the vehicle for testing.

NOTIFICATION OF COTR

The COTR must be notified within 24 hours after a vehicle has been delivered.

GOVERNMENT FURNISHED EQUIPMENT (GFE)

For the Forward Crash Warning Tests, no Government Furnished Equipment will be available or provided.

8. CALIBRATION AND INSTRUMENTATION

Before the Contractor initiates the test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in MIL-C-45662A, "Calibration System Requirements." The calibration system shall be set up and maintained as follows:

A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.

B. All measuring instruments and standards shall be calibrated by the Contractor, or a commercial facility, against a higher order standard at periodic intervals not exceeding 6 months for instruments and 12 months for the calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment. The calibration frequency can be increased if deemed necessary by NHTSA.

C. All measuring and test equipment and measuring standards will be labeled with the following information:

(1) Date of calibration

(2) Date of next scheduled calibration

(3) Name of the technician who calibrated the equipment

D. A written calibration procedure shall be provided by the Contractor which includes as a minimum the following information for all measurement and test equipment:

(1) Type of equipment, manufacturer model number, etc.

(2) Measurement range

(3) Accuracy

(4) Calibration interval

(5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)

(6) The actual procedures and forms used to perform the calibrations.

E. Records of calibration for all test instrumentation shall be kept by the Contractor in a manner that assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR and shall be included in the final test report. The calibration system will need the acceptance of the COTR before testing commences.

F. Test equipment shall receive a pre- and post-test zero and calibration check. This check shall be recorded by the test technician(s) and submitted with the final report.

NOTE: In the event of a failure to meet the standard's minimum performance requirements additional calibration checks of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration will be at the COTR's discretion and will be performed without additional cost.

9. PHOTOGRAPHIC DOCUMENTATION

Each vehicle shall be documented on color still pictures. Each test shall be documented on a color video camera. Sun, light glare, and shadows must be minimized so that views of the test are visible for visual analysis.

9.1 CAMERAS REQUIRED

CAMERA 1
Real-time video inside of the subject vehicle.

CAMERA 2
Real-time video behind the test vehicle.

CAMERA 3
Real-time video camera to one side of the most significant even area of the test.

CAMERA 4
A still camera to document the vehicle.

9.2 INFORMATIONAL PLACARDS

Vehicle identification placards shall be positioned so that at least 1 placard will be visible in the field-of-view for at least one video camera The following information will be shown:

A. Vehicle's NHTSA Number

B. The words “OCAS FORWARD CRASH WARNING CONFIRMATION TEST”

C. Date of test

D. Name of contract laboratory

E. Vehicle year, make and model

9.3 TEST FILM TITLE AND ENDING

Test video shall include the following title frames:

A. “The following Forward Crash Warning test was conducted under contract with the National Highway Traffic Safety Administration by (name and location of test laboratory)”

B. OCAS FORWARD CRASH WARNING CONFIRMATION TEST

TEST VEHICLE MODEL YEAR, MAKE AND MODEL

NHTSA No. CXXXXX

DATE OF IMPACT EVENT

CONTRACT NO.: DTNH22-XX-X-XXXXX

C. The ending frame shall state “THE END”

9.4 FILM EDITING

The film shall be edited in the following sequence:

A. Title

B. Pretest Coverage

C. Real Time Pan Coverage

D. Post test Coverage

E. “The End”

Any vehicle failures shall be completely documented.

9.11 STILL PHOTOGRAPHS

Provide still photographs (8 x 10 or $8^1/_2$ x 11 inch color prints properly focused for clear images) of pretest and post-test condition of entire vehicle deformation and details that pertain to the tested standards. Photographs of all areas of the test vehicle that may be of importance to the frontal barrier impact test should be taken in excess and developed only if the need arises.

The following still photographs are required for the test:

A. Pretest left side view of test vehicle

B. Pretest right front three-quarter view of test vehicle

C. Photograph of ballast installed in vehicle

D. Photograph of certification label

E Photograph of tire placard

F Photograph of the impact

10. DEFINITIONS

Forward Collision Warning Systems are intended to assist the driver in avoiding or mitigating the impact of rear-end collisions (i.e., a vehicle striking the rear portion of a vehicle traveling in the same direction directly in front of it). These types of safety systems have forward vehicle detection capability, such as RADAR, LIDAR (laser), camera, etc., and use this information to warn the driver to prevent crashes.

System Purpose:

- Forward Collision Warning (FCW) provides an audible, visual or haptic warning, or any combination thereof, to the driver of an FCW-equipped vehicle of a potential collision with another vehicle or vehicles in the anticipated forward pathway of the vehicle. FCW may be provided in combination with adaptive cruise control (ACC), but any form of ACC automatic vehicle control is not permitted during the following tests.

System Attributes:

- Provides for continuous monitoring of vehicles in the forward pathway of the FCW-equipped vehicle using sensing/communications technologies such as RADAR, LIDAR (laser), camera, etc., or any combination thereof. The FCW could function such that it is inactive in situations where the vehicle is traveling below a low speed threshold and/or when the driver has turned the system off.
- FCW does not require that the Principle Other Vehicle (POV) with which the equipped vehicle may potentially collide, be equipped with any special equipment.
- If the sensing device has detected a vehicle in the forward pathway of a FCW-equipped vehicle and there is a significant risk of a collision, an audible, visual or haptic warning, or any combination thereof, will be given to the driver of the FCW-equipped vehicle to help the driver avoid or mitigate a potential collision.
- There may be weather and/or infrastructure situations when the FCW system cannot detect vehicles in the forward pathway. FCW systems may also be limited in capability and/or accuracy due to other factors such as sensor blockage or interference, visibility conditions, roadway geometry, etc. In these situations, false, delayed, or missed warnings may occur.

11. PRETEST AND FACILITY REQUIREMENTS

11.1 DETAILED TEST AND QUALITY CONTROL PROCEDURES REQUIRED

Prior to conducting any test, Contractors are required to submit a detailed in-house test procedure to the COTR which includes:

A. A step-by-step description of the methodology to be used.

B. A written Quality Control (QC) Procedure which shall include calibrations, the data review process, report review, and the people assigned to perform QC on each task.

C. A complete listing of test equipment which shall include instrument accuracy and calibration dates.

D. Detailed checkoff lists to be used during the test and during data review. These lists shall include all test procedure requirements. Each separate checkoff sheet shall identify the lab, test date, vehicle and test technicians. These check sheets shall be used to document that all requirements and procedures have been complied with for each test. The check sheets should be kept on file.

There shall be no contradiction between the laboratory test procedure and the Contractor's in-house test procedure. The procedures shall cover all aspects of testing from vehicle receipt to submission of the final report. Written approval of the procedures must be obtained from the COTR before initiating the test program so that all parties are in agreement.

11.2 INSTRUMENTATION REQUIRED

TO BE EXPANDED.

11.2.1 EXTERNAL EQUIPMENT

The contractor shall supply a mid-sized passenger vehicle for a target “principle other vehicle.”

11.2.2 TEST VEHICLE INSTRUMENTATION

The subject vehicle should be instrumented with interior camera, including audio capability, to record the warning system response.

A system should be installed to determine “distance” from the principle other vehicle

12 Test Execution and Test Requirements

12. 1 Vehicle Test Weight

After the test vehicle is received, fluids will be added to specified levels or filled to capacity and the vhiel weight recorded at each wheel to determine the unloaded vehicle weight (UVW). Care must be taken to assure that any attachment hardware is adequately secured. The vehicle will then be loaded with one driver and all required equipment. Where possible, the equipment shall be place on the passenger side of the vehicle. Vehicle fuel must be maintained at least 75 percent full during the entire test program.

12.2 VEHICLE ATTITUDE

Determine the distance between a level surface, for example a flat roadway, and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its “as delivered” condition. The “as delivered” condition is the vehicle as received at the test site, with 100 percent of all fluid capacities (UVW condition) and all tires inflated to the manufacturer's specifications as listed on the vehicle's tire information label or placard.

12.3 VEHICLE FLUIDS

As specified above, all non-consumable fluids must be at 100 percent capacity. Fuel must be maintained at least 75 percent capacity during the testing.

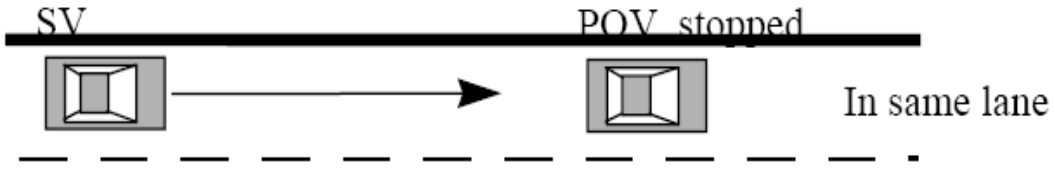
12.4 STANDARD TESTING CONDITIONS

- Unless specified otherwise, the road surface where the test is to be carried out should be dry (without visible moisture on the surface); the roadway should be straight, flat, with pavement in good condition; the roadway surface should be constructed from asphalt or concrete and free of potholes, bumps, and cracks that could cause the SV to pitch excessively. Test shall be conducted with no vehicles or obstructions on either side of the vehicle path within one lane width.
- Unless specified otherwise, the tests should be conducted during daylight hours with good visibility; The Contractor must verify that the temperature is between 0^{o} C (32^{o} F) to 40^{o} C (104^{o} F). The maximum wind speed shall be no greater than 10 m/s (22 mph).
- the tests should not be conducted when the wind speed is greater than 10 m/s and the ambient temperature should be between 1^{o} C to 38^{o} C.
- Unless stated otherwise, all tests should be conducted such that there are no overhead signs, bridges, or other significant structures over, or near, the testing site.
- If the FCW system provides a warning timing adjustment for the driver, at least one setting must meet the criterion of the test procedure.

12.5 TEST PROCEDURES

An FCW System shall be evaluated in accordance with the following test procedures.

12.5.1 Test 1 – Subject Vehicle (SV) Encounters Stopped Principal Other Vehicle (POV) on a Straight Road



This test evaluates the ability of the FCW function to detect a stopped lead vehicle. The test scenario is conducted at moderate (e.g., 45 mph or 72 kph) speed.

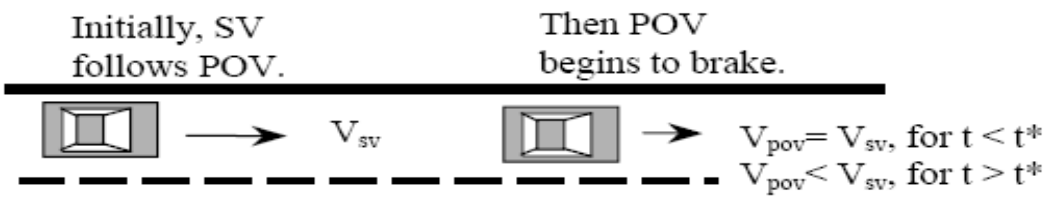
Alert Criteria:

Warning should be issued when time-to-collision (TTC) is at least 2.70 seconds (TTCW). TTC should be calculated for this test by assuming the current speeds of the driver's vehicle (SV) and the lead vehicle (POV). That is, this TTC provides a measure of the time it would take for the driver to collide with the lead vehicle if the driver and the lead vehicle continued at their current speeds (i.e., SV = 45 mph and POV = 0 mph).

Procedures for Test 1

1. Park the POV (e.g., a midsize sedan or a dummy vehicle fixture) in the center of a travel lane, with its longitudinal axis oriented parallel to the roadway edge, and the POV facing the same direction as the front of the SV, so the SV approaches the rear of the POV. Determine the position of the stationary POV.
2. Drive the SV at a nominal speed of 45 mph (72 kph) in the center of the lane of travel, toward the parked POV. The test begins when the SV is 150 meters from the POV and ends when either of the following occurs:
   a. The required crash alert occurs.
   b. The TTC to the POV falls to less than 90% of the minimum allowable range (i.e., 2.43 sec TTC) for the onset of the required crash alert.
3. After either 2a or 2b occurs, the SV driver must then steer and/or brake to keep the SV from striking the POV.
4. For a test trial to be valid, the following must hold throughout the test:
   a. The SV vehicle speed cannot deviate from the nominal speed by more than 1 mph (1.6 kph) during the test.
   b. SV driver cannot touch the brake pedal before the required crash alert occurs, or before the range falls to less than 90% of the minimum allowable range for onset of the required crash alert.
   c. The lateral distance between the centerline of the SV, relative to the centerline of the POV, in road coordinates, cannot exceed 0.6 meters.
5. The FCW system must pass five out of seven test trials and not fail two consecutive trials to pass the test. If the countermeasure passes the first five trials, it is not necessary to perform additional trials to verify that two consecutive failures not take place.

12.5.2 Test 2– Subject Vehicle (SV) Encounters Decelerating Principal Other Vehicle



The SV in this test is following the POV at a constant time gap initially and the POV suddenly decelerates.

The test evaluates the ability of the FCW in recognizing a decelerating lead vehicle and issuing an alert to SV in a timely manner.

Alert Criteria

Warning should be issued when time-to-collision (TTC) is at least 1.22 seconds TTCW. TTC should be calculated for this test by assuming the current speeds of the driver's vehicle (SV) and the lead vehicle (POV), as well as assuming the lead vehicle continued to decelerate at the prevailing deceleration value until it comes to a stop (i.e., at the current "constant" rate of slowing). This measure provides a measure of the time it would take for the driver to collide with the lead vehicle assuming the current speeds of the driver's vehicle and the lead vehicle, and assuming the lead vehicle continued to decelerate at the prevailing deceleration value until it comes to a stop.

Procedures for Test 2

1. This test starts with both the SV and the POV traveling on a straight, flat road at a constant speed of 45 mph (72 kph), in the center of the lane of travel. The headway from the SV to the POV should be maintained at 30 meters.
2. Begin the test 7 seconds before the driver of the POV starts a braking maneuver to quickly achieve and hold 0.32 g (3.14 m/s2) braking level within 1.5 seconds after brake onset. The test will end when either of the following conditions is satisfied:
   a. The required crash alert occurs.
   b. The TTC to the POV falls to less than 90% of the minimum allowable range (i.e., 1.22 sec TTC) for the onset of the required crash alert.
3. After either 2a or 2b occurs, the SV driver must then steer and/or brake to keep the SV from striking the POV.
4. For a test trial to be valid, the following must be satisfied:
   a. The initial POV vehicle speed cannot deviate from the nominal speed by more than 1 mph (1.6 kph) during the test.
   b. Speed of the SV cannot deviate from the nominal speed by more than 1 mph (1.6 kph) during the test.
   c. The lateral distance between the centerline of the SV, relative to the centerline of the POV, in road coordinates, cannot exceed 0.6 meters.
   d. The difference between the initial SV and POV speeds cannot be larger than 1 mph (1.6 kph) during the test.
   e. 1.5 seconds after POV braking onset, the POV deceleration level should nominally be -0.32g (3.14 m/s2), with an acceptable error magnitude of 0.03g (0.29 m/s2), until the test is over. The POV driver is not permitted to reach the target POV deceleration range (0.29 – 0.35g) until 1.0 seconds after POV braking offset. Once the POV driver reaches this target deceleration range, the driver must remain within this range throughout the remainder of the test.
   f. The tolerance for the headway from the SV to the POV should be +/- 1.5 meters.
   g. The SV driver cannot touch the brake pedal before the required crash alert occurs, or before the range falls to less than 90% of the minimum range allowed for onset of the required crash alert.
5. The FCW system must pass five out of seven test trials and not fail two consecutive trials to pass the test. If the countermeasure passes the first five trials, it is not necessary to perform additional trials to verify that two consecutive failures not take place.

12.5.3 Test 3 – Subject Vehicle (SV) Encounters Slower Principal Other Vehicle (POV)

This test examines the ability of the FCW system to recognize the dynamic state of a slower lead vehicle (constant speed) and issue a timely alert. The scenario should be conducted at a closing speed equal to 25 mph (40 kph).

Alert Criteria

Warning should be issued when time-to-collision (TTC) is at least 1.86 seconds. TTC should be calculated for this test by assuming the current speeds of the driver's vehicle (SV) and the lead vehicle (POV). That is, this TTC provided a measure of the time it would take for the driver to collide with the lead vehicle if the driver and the lead vehicle continued at their current speeds (i.e., SV = 45 mph and POV = 20 mph).

Procedures for Test 3

1. Throughout the test, the POV is to be driven at a constant 20 mph (32 kph) in the center of the lane of travel.
2. The SV is to be driven at 45 mph (72 kph) (i.e., 25 mph (40 kph) faster than the speed of POV), in the center lane of travel, toward the slow-moving POV.
3. The test begins when the SV is 150 meters from the POV and ends when either of the following occurs:
   a. The required crash alert occurs.
   b. The TTC to the POV falls to less than 90% of the minimum allowable range (i.e., 1.80 sec TTC) for the onset of the required crash alert.
4. After either 3a or 3b occurs, the SV driver must then steer and/or brake to keep the SV from striking the POV.
5. For a test trial to be valid, the following must hold throughout the test:
   a. Speed of the POV cannot deviate from the nominal speed by more than 1 mph (1.6 kph) during the test.
   b. Speed of the SV cannot deviate from the nominal speed by more than 1 mph (1.6 kph) during the test.
   c. The lateral distance between the centerline of the SV, relative to the centerline of the POV, in road coordinates, cannot exceed 0.6 meters.
   d. The SV driver cannot touch the brake pedal before the required crash alert occurs, or before the range falls to less than 90% of the minimum range allowed for onset of the required crash alert.
6. . The FCW system must pass five out of seven test trials and not fail two consecutive trails to pass the test. If the countermeasure passes the first five trails, it is not necessary to perform additional trails to verify the two consecutive failures not take place.

13. POST TEST REQUIREMENTS

Collect all data necessary to complete the final test report data sheets and provide details of any problem areas.

14. REPORTS

14.1 MONTHLY STATUS REPORTS

The Contractor shall submit a monthly Test Status Report and a Vehicle or Equipment Status Report to the COTR (both reports shown in this section). The Vehicle Status Report shall be submitted until all vehicles or items of equipment are disposed of.

14.2 TEST ANOMOLIES

In the event of an apparent test failure, a post-test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OCAS.

14.3 FINAL TEST REPORT

14.3.1 COPIES

One(1) CD per test. Please add two items to the CD's. Place a JPG of the test vehicle – 180 by 300 pixels and around 10 KB. For the second item, place a test video on the CD.

One paper copy of each Final Test Report.

The above documentation shall be submitted to the COTR according to the schedule indicated in section 6.

Payment of Contractor's invoices for completed tests may be withheld until the Final Test Report is accepted by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided copies of the Final Test Report.

Contractors are required to submit one color copy of each Final Test Report in draft form. DO NOT stamp preliminary or draft on this report. The COTR will review the draft report and notify the laboratory of any corrections that are required. If we agree to make changes to the test report, mail the appropriate (the changed) pages to us. We will insert the new pages into the preliminary test report. At the end, we will accept the preliminary test report with the inserted pages as the final test report.

Contractors are required to PROOF READ all Final Test Reports before submittal to the COTR. The OCAS will not act as a report quality control office for Contractors. Reports containing a significant number of errors will be returned to the Contractor for correction, and a "hold" will be placed on invoice payment for the particular test.

14.3.2 REQUIREMENTS

The Final Test Report, associated documentation (including photographs) is relied upon as the chronicle of the test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself.

The Contractor should use detailed descriptions of all test events. Any events that are not directly associated with the test program but are of technical interest should also be included. The Contractor should include as much detail as possible in the report.

Instructions for the preparation of the first three pages of the final test report are provided below for the purpose of standardization.

14.3.3 FIRST THREE PAGES

Front Cover - - A heavy paperback cover (or transparency) shall be provided for the protection of the final report. The information required on the cover is as follows:

(A) Final Report Number such as OCAS-ABC-0X-001

where - -

OCAS is the Office of Crash Avoidance Standards,
ABC are the initials for the laboratory
0X is the Fiscal Year of the test program
001 is the Group Number (00 1 for the 1st test, 002 for the 2nd test, 003for the 3rd test, etc.)

(B) Final Report Title And Subtitle such as

Forward Crash Warning System Confirmation Test
****
World Motors Corporation
200X XYZ 4-door sedan
NHTSA No. CX0401

(C) Contractor's Name and Address such as

XYZ TESTING LABORATORIES, INC.
4335 West Dearborn Street
Detroit, Michigan 48090

NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (C) AND (D)

(D) Date of Final Report completion

(E) The words “FINAL REPORT”

(F) The sponsoring agency's name and address as follows

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crash Avoidance Standards
Mail Code: NVS-120
1200 New Jersey Avenue SE, Room W43-478
Washington, DC 20590

14. REPORTS.... Continued

First Page After Front Cover - - A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows:

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Prepared By: _____

Approved By: _____

Approval Date: _____

FINAL REPORT ACCEPTANCE BY OCAS:

_____
Manager, NHTSA, Office of Crash Avoidance Standards

Date: _____

_____
COTR, NHTSA, Office of Crash Avoidance Standards

Date: _____

14. REPORTS.... Continued

Second Page After Front Cover - - A completed Technical Report Documentation Page (Form DOT F1700.7) shall be completed for those items that are applicable with the other spaces left blank. Sample data for the applicable block numbers of the title page follows.

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OCAS-ABC-0X-001

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Leave blank

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Leave blank

Block No. 4 - - TITLE AND SUBTITLE

Final Report of Forward Crash Warning Testing
of a 200X World XYZ Deluxe 4-door sedan
NHTSA No. CX0401

Block No. 5 - - REPORT DATE

March 1, 200X

Block No. 6 - - PERFORMING ORGANIZATION CODE

ABC

Block No. 7 - - AUTHOR(S)

John Smith, Project Manager
Bill Doe, Project Engineer

Block No. 8 - - PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block No. 9 - - PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, Ml 48070

14. REPORTS.... Continued

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DTNH22-0X-D-1 2345

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U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crash Avoidance Standards
Mail Code: NVS-120
1200 New Jersey Avenue SE, Room W43-478
Washington, DC 20590

Block No. 13 - - TYPE OF REPORT AND PERIOD COVERED

Final Test Report
XXX to XXX, 200X

Block No. 14 - - SPONSORING AGENCY CODE

NvS-120

Block No. 15 - - SUPPLEMENTARY NOTES

Leave blank

Block No. 16 - - ABSTRACT

These tests were conducted on the subject 200X World XYZ 4-door sedan in accordance with the specifications of the Office of Crash Avoidance Standards Test Procedure No. TP-OCAS-XX for the confirmation of a forward crash warning system.

Block No. 17 - - KEY WORDS

Forward Crash Warning, FCW

14. REPORTS.... Continued

Block No. 18 - - DISTRIBUTION STATEMENT

Copies of this report are available from the following:

NHTSA Technical Reference Division
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE,
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Add appropriate number

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14.3.4 TABLE OF CONTENTS ..... PAGE NO.

Sample Test Report Table of Contents:

A. Section 1 — Purpose and Summary of Test

B. Section 2 — Occupant and Vehicle Information/Data Sheets

C. Section 3 — Photographs

D. Section 4 — Vehicle data traces.

E. Section 5 — Test Equipment and Instrumentation Calibration

14. REPORTS.... Continued

14.3.5 SAMPLE TEST REPORT INFORMATION

PURPOSE AND SUMMARY OF TEST

PURPOSE

This test is part of the Crash Avoidance program to assess Frontal Crash Warning Systems sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No._____. The purpose of this test was to obtain vehicle crash avoidance performance data for _____.

SUMMARY

DATA SHEET NO. DESCRIPTION

1. Test Summary
2. General Test and Vehicle Parameter Data
3. Post test Data
4. Test Vehicle Information
5. Vehicle Measurements

15. DATA SHEETS

DATA SHEET NO. 1

TEST SUMMARY

Vehicle NHTSA No.: _____

Test Date: _____ Time: _____ Temperature: _____ ^{o}C

Vehicle Make/Model/Body Style: _____

Vehicle Test Weight: _____ kg

Forward Crash Warning Confirmed _____

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: _____

NHTSA No.: _____; VIN: ; Color: _____

Engine Data: _____ cylinders; _____ CID; _____ Liters; _____ cc

Transmission Data: _____ speeds; _____ Manual; _____ Automatic; _____ Overdrive

Final Drive: ___ Rear Wheel Drive; ___ Front Wheel Drive; _____ Four Wheel Drive

Major Options: _____ A/C; _____ Pwr.Strg.; _____ Pwr. Brakes

_____ Pwr. Windows; _____ Pwr. Door Locks; _____ Tilt Wheel

Date Received: _____; Odometer Reading _____ km

Dealer/leasee: _____

& Address: _____

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: _____

Date of Manufacture _____

GVWR: _____ kg; GAWR: _____ kg FRONT; _____ kg REAR

DATA FROM TIRE OR TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load: _____ kpa FRONT

_____ kpa REAR

Load Index & Speed Symbol: _____

Recommended Tire Size: _____

* Recommended Cold Tire Pressure: _____ kpa FRONT; _____ kpa REAR

Tire Grades: _____

Treadwear; _____ Temperature; _____ Traction

Size of Tires on Test Vehicle: _____; Manufacturer: _____

Vehicle Capacity Data:

Type of Front Seats: _____ Bench; _____ Bucket; _____ Split Bench

Number of Occupants: _____ Front; _____ Rear; 0 _____ Total

Vehicle Capacity Weight (VCW) = _____ kg

No. of Occupants x 68 kg = _____ kg

Rated Cargo/Luggage Weight (RCLW) = _____ kg

*Tire pressure used for test

15. DATA SHEETS... Continued

DATA SHEET NO. 2 GENERAL TEST AND VEHICLE PARAMETER DATA (cont.)

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids) = UDW:

Right Front = _____ kg Right Rear = _____ kg

Left Front = kg Left Rear = kg

TOTAL FRONT = _____ kg TOTAL REAR = _____ kg

TOTAL DELIVERED WEIGHT = _____ Kg

% of Total Front of Vehicle Weight = _____ % of Total Rear Weight = _____ %

WEIGHT OF TEST VEHICLE

Right Front = _____ kg Right Rear = _____ kg

Left Front = _____ kg Left Rear = _____ kg

TOTAL FRONT = _____ kg TOTAL REAR = _____ kg

TOTAL TEST WEIGHT = _____ Kg

% of Total Front Weight = _____ % % of Total Rear Weight = _____ %

FUEL SYSTEM DATA :

Fuel System Capacity From Owner's Manual = _____ liters

Usable Capacity Figure Furnished by COTR = _____ liters

Test Volume Range (75 % to 100% of Usable Capacity) = _____ to _____ liters

ACTUAL TEST VOLUME= _____ liters (with entire fuel system filled)

DATA SHEET NO. 3

PHOTOGRAPHS

References

Ference, J. J., Szabo, S., and Najm, W. G. (2007). Objective Test Scenarios for Integrated Vehicle-Based Safety Systems (Paper Number 07-0183). *Proceeding* from the *20th Enhanced Safety of Vehicle Conference, Innovations for Safety: Opportunities and Challenges*.

Kiefer, R., LeBlanc, D., Palmer, M., Salinger, J., Deering, R., and Shulman, M. (August 1999). *Development and Validation of Functional Definitions and Evaluation Procedures for Collision Warning/Avoidance Systems* (DOT HS 808 964). Washington, DC: U.S. Department of Transportation.

Najm, W. G., Stearns, M. D., Howarth, H., Koopmann, J., and Hitz, J. (April 2006). *Evaluation of an Automotive Rear-End Collision Avoidance System* (DOT HS 810 569). Washington, DC: U.S. Department of Transportation.

Szabo, S. and Norcross, R. (April 2006). *Literature Review of Collision Warning System Test Procedure* (*Internal Project Report for IVBSS*). Gaithersburg, MD: National Institute of Standard and Technology.